IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: Diane Elsie Hall	)	Confirmation No. 1916
APPLICATION NO.: 10/535,076	)	Group Art Unit 1797
FILED: May 13, 2005	)	Examiner: James C. Goloboy
TITLE: Method of Reducing Particulate Emissions	)	Atty. Docket No.: BP9861

DECLARATION OF DR. GORDON DAVID LAMB UNDER 37 C.F.R. 1.132

Mail Stop AF
Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia 22313-1450

Dear Sirs:

I, Gordon David Lamb residing at Padley House, Southend Road, Bradfield Southend, Berkshire, England RG7 6ES, make the following declaration:

1. I graduated from the University of Birmingham, UK, with a B.Sc. (Honours) degree in Chemistry in 1985 and from the University of Birmingham, UK, with a Ph.D. degree in Polymer Chemistry in 1989.

2. My research Ph.D. was sponsored by Castrol Limited., and involved research into lubricant additives and their degradation mechanisms at elevated temperatures.

3. I am presently employed by BP Oil UK Ltd and have been since March, 2002. I have held the position of Advisor in BP's Professional Advisor Programmme since 2004, specialising in engine oil lubricants. I offer technology advice on a range of issues relating to the research and development of lubricant formulations within BP.

4. Prior to my joining BP I was employed by Lubrizol Limited. (a wholly owned subsidiary of Lubrizol Corporation) since August, 1990. In my time at Lubrizol I was employed as an engine oil formulator and latterly as the Technology Manager for heavy duty diesel

lubricants in Europe. During my time with Lubrizol I spent over two years working in the corporate headquarters in Wickliffe, Ohio from July, 1996 until November, 1998. During this time I worked on developing heavy duty diesel lubricants for North American customers of Lubrizol. I also spent 9 months working in the research department in Wickliffe, Ohio from February to November, 1998.

5. I have specialised in developing and formulating heavy duty diesel lubricants since 1995. I also have experience of developing European passenger car lubricants for gasoline and diesel engines (1999 – 2001 for Lubrizol, and since 2002 for BP).

6. I have been a member of the Society of Automotive Engineers (SAE) since 1996 and have reviewed SAE papers for publication.

7. I hold the following eleven U.S. patents in the field of lubricant formulations: U.S. 6,121,211; U.S. 6,207,624; US 6,310,009; U.S. 6,331,510; U.S. 6,559,105; U.S. 6,583,092; U.S. 6,605,572; U.S. 6,610,637; U.S. 6,764,982; US 6,770,605; and U.S. 7,285,516.

8. I wrote a chapter on lubricant additives with Ewa Bardasz, which was published in "Lubricant Additives, Chemistry and Applications", pages 387-428, edited by Les Rudnick, Marcel Dekker, New York, 2003.

9. I have presented at several international conferences principally on the subject of engine lubricants (e.g. Royal Society of Chemistry Additives 2007, Engine Expo 2005, Emissions Control, Technische Universitat Dresden 2004) and have lectured on ZDDP at Technische Akadaemie Esslingen in Stuttgart, Germany.

10. I represented BP on Association Technique de L'Industrie Europeene Des Lubrifiants' (ATIEL) Committee for developing base oil guidelines for the European Automobile Manufacturers Association's (ACEA) European engine oil sequences.

11. I have accompanied and assisted the professional representative for Castrol Limited at three oral opposition proceedings at the European Patent Office in Munich in 2007 and 2008, opposing the grant of two patents and defending one patent.

12. I have carefully read United States patent application number 10/535,076 and am aware of the technical features which are the basis for the invention in the claims on file at June 4, 2009. The unexpected effect of a low sulfur fuel in combination with a low sulfur lubricant and catalyzed particulate trap to significantly reduce the number of nucleation mode particles is shown by the three factor test matrix of fuel sulfur, lubricant sulphur and catalyzed particulate trap in Figures 1 and 2 of the application.

13. I have examined the data in the aforesaid United States patent application and would like to draw attention to the fact that there is no correlation in Figure 1 between diesel exhaust particle mass and sulfur from either the fuel or lubricant in the *absence* of a catalyzed particulate trap. The lack of correlation in the absence of a catalyzed particulate trap is also evident with the number of nucleation mode particles in Figure 2. However when the catalysed particulate trap is used, the correlation between fuel-lubricant sulfur and the number of nucleation mode particles becomes evident in Figure 2. The fuel sulfur and lubricant sulfur contents defined in the claims of the application on file as of June 4, 2009 are important for reducing the number of nucleation mode particles and *only when used with a catalyzed particulate trap.*

14. The diesel fuel sulfur contents specified in Applicant's Claims 16, 25 and 26 are not typical of US on-highway diesel engines as of the November 15, 2002 priority date of the PCT application that is the parent of United States patent application no. 10/535,076. In 2002 typical diesel fuel sulfur levels in the US were 350 ppm (reference ASTM D975). US Federal law has only required less than 15 ppm sulfur for fuel for on-highway heavy duty diesel engines since 2007.

15. In November, 2002, lubricant sulfur levels were not mandated in the American Petroleum Institute (API) 1509 Code of Practice for heavy duty diesel engines. The low sulfur lubricant tested in the patent application was not typical compared to API CI-4 (in ASTM D4485) heavy duty diesel lubricants in 2002. Since 2006 API CJ-4 (in ASTM D4485) lubricants have had a maximum permitted sulfur level of 0.4%. The lubricant sulfur levels in Applicant's Claims 33, 34 and 35 are lower than the 0.4% mandated for API CJ-4 and are illustrated in Applicant's examples at 0.14% sulphur.

16. I have read Chamberlin's U.S. Patent No. 6,588,393 B2. It would be clear to anyone skilled in the art that Chamberlin's lubricating oils, examples A and B, would not be suitable for use in heavy duty diesel engines, at least for the following reasons:

The lubricant described in examples A and B (column 17) does not contain zinc dialklydithiophosphate (ZDDP) which is the standard anti-wear additive for heavy duty diesel engine oils. I note that Chamberlin incorrectly refers to a metal containing additive containing phosphorus as an extreme-pressure additive (column 18, line 45) when it would normally be referred to as an anti-wear additive by anyone skilled in the art. ZDDP's have been used in engine lubricants since the 1940's and are the principle anti-oxidant and anti-wear additive for engine oils. Their unique ability to combine anti-oxidant and anti-wear properties has made them requisite in engine oils. Early engine oils used primary ZDDP's. Since the 1990's most engine oils have used secondary ZDDP's as these have better anti-wear properties in API and ACEA engine tests.

Due to concerns over compatibility of phosphorus and sulfur with exhaust catalyst systems the maximum level of phosphorus and sulfur in engine oils has been restricted in API and International Lubricants Standardization and Approval Committee (ILSAC) oil specifications. In 1987 the phosphorus level in API SG (in ASTM D4485) was limited to 0.12% max. Since 2005 the sulphur level in API SM (in ASTM D4485) was limited to 0.5% max in

SAE 5W-30 oils. Engine oils are typically formulated close to the maximum permitted level of phosphorus in order to maximise the level of ZDDP in the lubricant. The sulfur and phosphorus levels for three current oil specifications are as follows:

	Phosphorus	Sulfur
ILSAC GF-4	0.08% Max	0.5% Max
API CJ-4	0.12% Max	0.4% Max
ACEA E6	0.08% Max	0.3% Max

17. The low sulfur lubricant in the example on page 5 of Applicant's U.S. patent application number 10/535,076 contains ZDDP at 0.38% which equates to a phosphorus level of 0.038% (ZDDP contains 10% phosphorus). Whilst this phosphorus is low compared to the current API CJ-4 specifications, it is still sufficient for use in a diesel engine albeit at a potentially reduced oil drain interval. This can be contrasted with Chamberlin's lubricant's in examples A and B, column 17, lines 30-63 which contain no anti-wear additives and no detergents. Additives for current heavy duty diesel engine oils must contain at least dispersant, detergent (calcium, magnesium or sodium salts of sulfonates, phenates or salicylates), and ZDDP in order to function properly. Taking out the ZDDP would be a significant departure from formulating norms.

18. Chamberlin only discloses test results from a split engine i.e. an engine with a separated crankcase and valve-train lubricant circuit. One skilled in the art would not expect that Chamberlin's low sulfur oil would work in a conventional heavy duty diesel engine for the reasons described above, that is, that it does not have any anti-wear additives. A second conventional lubricant would also be required for the high wear valve train. Current U.S. heavy duty diesel engines do not have a separate valve-train and crankcase lubricant system. Examples of current heavy duty diesel engines in the U.S. are: Cummins ISX, Detroit Diesel Series 60, and Mack ASET. Chamberlin's experiments in a split lubricated engine

could therefore not be described as an example of typical operation for a heavy duty diesel engine.

19. I have considered whether Chamberlin's oil without an anti-wear additive could be used in a heavy duty diesel engine. One possible way to reduce the need for an anti-wear additive is to eliminate or reduce the high contact stresses. This potentially could be achieved by using cam-less engine technology. This technology is referred to in Chamberlin's patent as a potential way to allow his claimed lubricant to work. A drawback with this technology is that ZDDP additives are still necessary to prevent bearing wear and corrosion in non-valve train parts of the engine. Furthermore, as far as I am aware, there are no heavy duty diesel engines on the market using cam-less engine technology in which the valves are opened and closed for operation by some other means than a cam shaft. The concept of these devices has been discussed and investigated by several OEM's but none have been commercialised for on-highway heavy duty diesel engines

20. Chamberlin's claim of reduced NOx emissions after catalyst in Figure 2 would not necessarily correlate to reduced particulate mass or number of particulate emissions in a diesel engine. It is well known that reducing the level of NOx emissions in a diesel engine will generally increase the mass of particulates emitted out of the engine. This is one of the dilemmas facing engine designers as they strive to reduce both NOx emissions and particulate levels. Therefore it would not be expected that Chamberlin's invention would lead to reduced numbers of nucleation mode particles due to reduced NOx emissions. In addition to this effect of the engine itself, catalyzed particulate traps often require NOx in engine emissions for their catalytic operation.

21. I hereby declare that all statements made in this Declaration of my own knowledge are true and that all statements made on information and belief are believed by me to be true, and further that these statements are and were made with the knowledge that willful false

statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC 1001 and that such willful false statements may jeopardize the validity of the patent application here under consideration and any patent issued thereon.

Signed By: Gordon David Lamb
Gordon David Lamb

Dated: June 17, 2009